

Reactions of Alkenes: Summary

Intermediate:	<u>Carbocation</u>	<u>Radical</u>	<u>3-Membered Ring</u>	<u>None or Cyclic (concerted)</u>
Regiochemistry:	Markovnikov*	Anti-Markovnikov*	Markovnikov-like	N/A
Addition:	Syn & Anti	Syn & Anti	Anti	Syn
Rearrangements?	yes	no	no	no

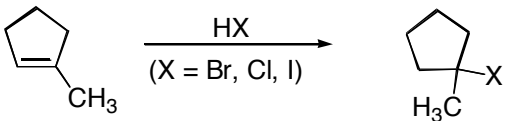
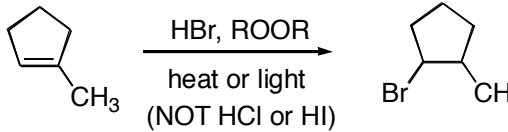
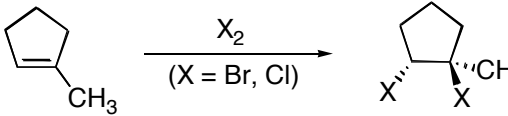
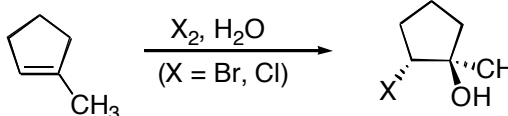
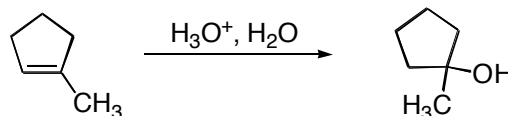
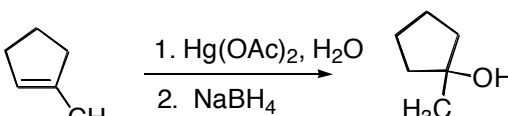
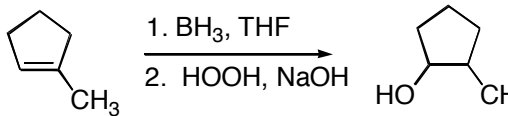
*the reaction goes through the pathway of the most stable intermediate;
the more substituents on an electron deficient carbon (carbocation or radical), the greater its stability

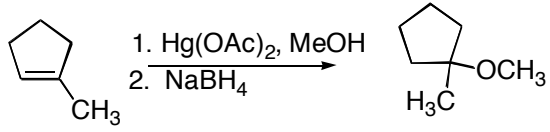
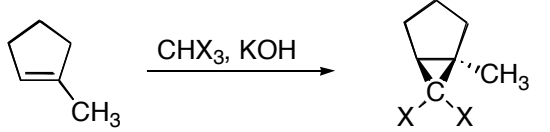
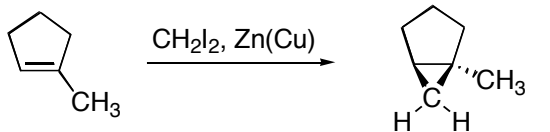
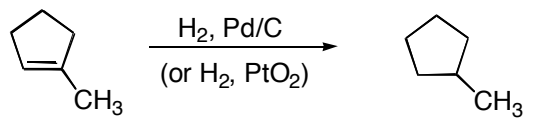
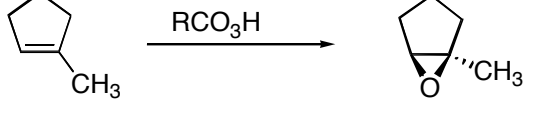
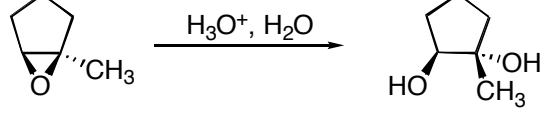
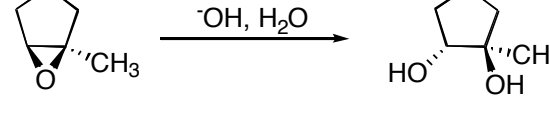
Stereochemistry:

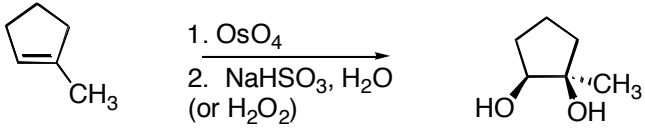
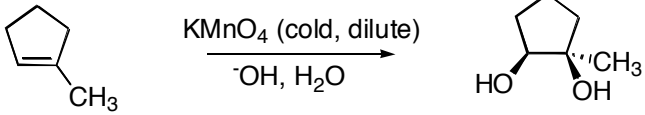
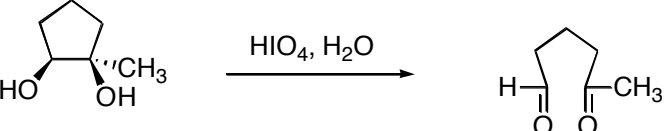
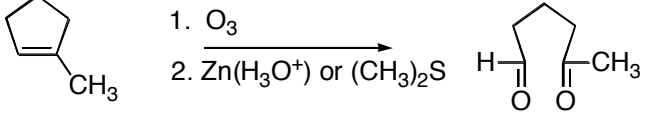
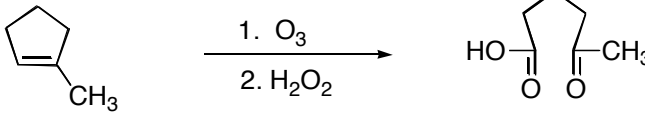
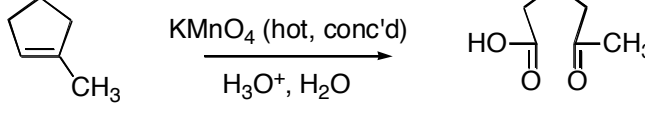
- If the reactants are optically inactive (achiral), the products will be optically inactive (achiral, racemic or meso)
- If the reactants are optically active (chiral), the products will be optically active (unequal mixture of enantiomers, unequal mixture of diastereomers, or 1 enantiomer)
- Use 2^n of the product to predict the maximum number of stereoisomers
(if just anti or just syn addition, divide the maximum number of stereoisomers by 2)

Predicting the type of intermediate:

- Carbocation - H is the electrophile (no lone pair to share with the empty p orbital)
- Radical - an initiator with a weak bond (ex. ROOR) and an energy source (heat or light) is present
- 3-Membered Ring - the electrophile has a lone pair of electrons available to share with the empty p orbital
- None or Cyclic - the electrophile can both accept and donate electrons at the same time

	Alkyl halide	Carbocation	syn + anti	Markovnikov
	Alkyl halide	Radical	syn + anti	Anti-Markovnikov
	Vicinal dihalide	3-membered ring	anti	Markovnikov-like
	Halohydrin	3-membered ring	anti	Markovnikov-like
	Alcohol	Carbocation	syn + anti	Markovnikov
	Alcohol	3-membered ring	anti	Markovnikov-like
	Alcohol	None (concerted)	syn	Anti-Markovnikov

	Ether	3-membered ring	anti	Markovnikov-like
	Cyclopropane	None (concerted)	syn	N/A
	Cyclopropane	None (concerted)	syn	N/A
	Alkane	Heterogeneous	syn	N/A
	Epoxide	None (concerted)	syn	N/A
	<i>trans</i> -1,2-diol	3-membered ring	anti	N/A
	<i>trans</i> -1,2-diol	None (concerted)	anti	N/A

 <p>1. OsO_4 2. $\text{NaHSO}_3, \text{H}_2\text{O}$ (or H_2O_2)</p>	<i>cis</i> -1,2-diol	Cyclic (concerted)	syn
 <p>KMnO_4 (cold, dilute) $\text{OH}^-, \text{H}_2\text{O}$</p>	<i>cis</i> -1,2-diol	Cyclic (concerted)	syn
 <p>$\text{HIO}_4, \text{H}_2\text{O}$</p>	Aldehydes and Ketones	Cyclic (concerted)	syn
 <p>1. O_3 2. $\text{Zn}(\text{H}_3\text{O}^+) \text{ or } (\text{CH}_3)_2\text{S}$</p>	Aldehydes and Ketones	Cyclic (concerted)	syn
 <p>1. O_3 2. H_2O_2</p>	Carboxylic acids and Ketones	Cyclic (concerted)	syn
 <p>KMnO_4 (hot, conc'd) $\text{H}_3\text{O}^+, \text{H}_2\text{O}$</p>	Carboxylic acids and Ketones	Cyclic (concerted)	syn